Architecture & Framework

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Overview

- Architectural Task Force
  - Architectural vision
- Architecture Team
  - Framework Design & Implementation
- Milestones
- Closing Remarks

Architecture Task Force

- **Established June 1999**
  - Katsuya Amako (KEK)
  - Laurent Chevalier (Saclay)
  - Andrea Dell'Acqua (CERN)
  - Fabiola Gianotti (CERN)
  - Stephen Haywood (RAL) - Chair
  - Norman McCubbin (RAL)
  - Helge Meinhard (CERN)
  - David Quarrie (LBNL)
  - RD Schaffer (CERN+LAL)
  - Marjorie Shapiro (LBNL)
  - Valerio Vercesi (INFN)
  - Torsten Akesson (ATLAS management)

ATF - Mandate

- "… specify the global architecture of ATLAS computing in a way that provides a unified execution framework for data access, reconstruction, simulation, analysis and event display."
- "… a database interface making ATLAS independent of database supplier."
- "Full attention should be given to implementations already carried out in previous and upcoming experiments…"
- "A first version of the architecture document should be made available to the collaboration at the latest three months after the launch of the taskforce."
- "The taskforce will have a composition taken from a large base in the collaboration so as to ensure that the architecture will be one with a broad support."

Glossary

- Architecture
  - The structure of the system, comprising the components, the externally visible properties, and the relationships among them
- Framework
  - Represents a collection of classes that provide a set of services for a particular domain
  - A concrete realization of an architecture
- Component
  - A physical and replaceable part of a system that conforms to and provides the realization of a set of interfaces

ATF - Work

- Presentations (LHCb, *BABAR*, CDF, D0,…)
- Architectural Design
  - Two approaches to identify components, responsibilities and relationships
    - Prior experience
    - Unified Software Development Process (USDP) based approach
  - Approaches complementary and expected to derive essentially same conclusions
    - Validation of conclusions
  - Merging incomplete

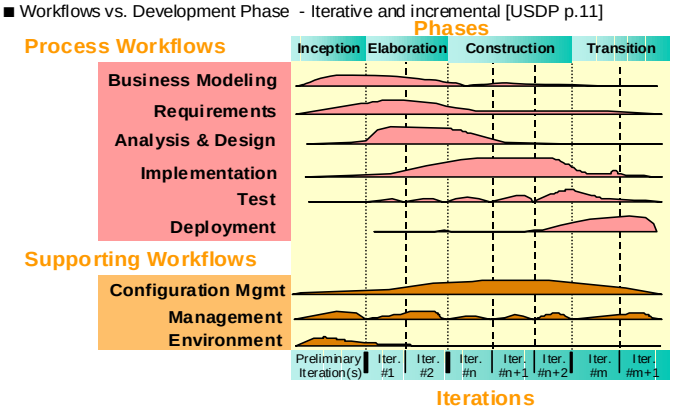
USDP

- Unified Software Development Process
  - Booch, Jacobson, Rumbaugh
- Unified Modelling Language (UML) as notation
- Development is use-case driven
- Multiple phases
  - Requirements, Analysis, Design, Implementation, Testing, *etc.*
- Incremental
- Iterative

USDP Phases

Software Development Process: USDP

■ Workflows vs. Development Phase - Iterative and incremental [USDP p.11]



Atlas Software Week 1999.09.01 K.Amako 20

Core Abstractions

- Modules/Algorithms
  - Computational code
- Data Objects
  - Transient objects capable of being converted
- Converters
  - Convert data from one representation to another
    - Transient/Persistent
    - Transient/Graphical
- Services
  - Components that provide a support service
- Stores

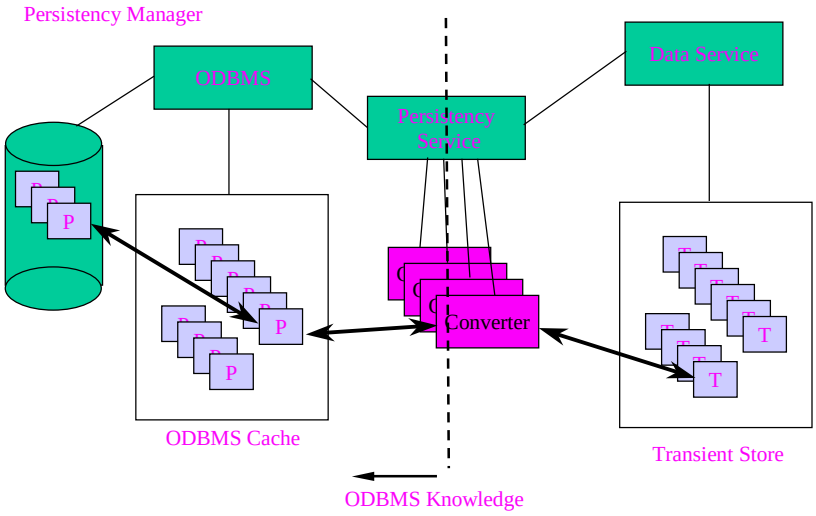
ATF - Components

Configuration & Execution Components	*Manager Components*	*Data Components*	*Additional Services & Components*
Framework Manager	Event Input	Event	User Interface
Application Manager	Event Output	Detector Description	Message Service
Job Options Service	Data Item Selector	Conditions Data	Bookkeeping
	Event Collection Manager	Statistics Data	History
	Event Merge	Magnetic Field	Particle Properties
	Module Interface		

ATF - Major Decisions

- Object oriented paradigm
  - C++ implementation language
  - Java forseen
- Separation of Data and Algorithms
  - See later slide
- Separation of Transient and Persistent Data
  - Independence from persistent implementation
- Transient Event Store as scratchpad
  - Owner of intermediate results
  - Communication between Modules/algorithms

Transient/Persistent Separation



Architecture Team

- Detailed Design and Implementation
  - Led by Chief Architect
- Three USA Members
  - David Quarrie (LBNL) - Chief Architect [*]
    - [*] Still under discussion with Norman
  - Craig Tull (LBNL)
  - Paulo Calafiura (LBNL)
- One other known Member
  - Katsuya Amako (KEK)
- Others still being sought by Norman
- Goal is ~6 people

A-Team - Work

- Core team augmented
  - Database
  - Graphics
  - Reconstruction
  - Simulation
  - Physics Analysis
  - …
- Relationship to other computing groups still being understood
  - Very useful feedback from John Harvey

A-Team - Approach

- Not waiting for rest of team
- Multi-pronged approach
  - Understand present Computing Infrastructure
  - Preliminary task list & milestones
  - Establish contact with software groups (reconstruction, *etc.*)
  - May prototype based on GAUDI
    - See next slide
  - USDP work
    - Katsuya augmented by Chris Day (LBNL)
      - Propose Chris as software process librarian
      - Experienced in USDP and Rational Rose

GAUDI

- LHCb Architecture
  - John Harvey, Pere Mato et al.
- Embodies a coherent vision
- Clear distinction between abstractions and implementations
- Identifies many of the same components as the ATF
  - Not really surprising
    - Mutual incorporation of ideas and experience
- In third release iteration

GAUDI *vs* *BABAR*/CDF

- Embodies a more coherent vision
- Better use of abstractions
- Capable of using *BABAR*/CDF components
  - E.g. *BABAR* ProxyDict as transient event store
- Better capable of being used in distributed environment
- Support for multiple scripting languages
- Suitable for Java
- Maturity vs. potential
  - Believe GAUDI has more potential

Major Milestones

- May 2000 Prototype Reconstruction Framework
  - Based on GAUDI
- Jun 2000 Alpha Design Review
- Sep 2000 Alpha Reconstruction Framework
  - Incorporate USDP feedback
- Mar 2001 Freeze V2 functionality
- Jul 2001 V2 Design Review
- Oct 2001 V2 Reconstruction Framework
- Apr 2002 Freeze V3 functionality
  - Distributed (support computational grid)
- *etc.*
- Expect minor releases at ~3-4 month intervals

May 2000 Prototype

- Major concern is credibility
- We can't afford not to deliver something
- Crucial to gain acceptance from users
- Propose to provide something close to PASO shell but with much better functionality and potential for extensibility
  - Easy to incorporate existing development
  - Existing user community
  - Defuse further development on PASO
    - Trying to get PASO developers to help with tutorials *etc.*

May 2000 Prototype

- Proposal is to base on GAUDI
  - Basic transient event store
    - Evaluating *BABAR*/GAUDI/CDF versions now
    - Incorporate existing transient event model (Schaffer et al.)
      - Recognize that this needs to be replaced
    - Read TDR simulation data
    - Allows existing ATLAS reconstruction modules to be incorporated with only minor changes
  - Extend GAUDI
    - Sequencing Service
    - Commands
    - Command Interpreter instead of job options

May 2000 Functionality

- Support for TDR simulation data
- Existing XML Detector Description Model
- Existing ATLAS visualization
- Limited ability for persistent output
- Sequencing of multiple algorithms/modules
  - Follow *BABAR*/CDF model of multiple paths comprising multiple modules capable of filtering
    - Hypothesis-based processing
      - Each path corresponds to a physics signal
        - Succeeds if event meets filter criteria
- Dynamic loading of user modules

Parallel Development

- Going for a GAUDI-based May 2000 prototype doesn't mean simple adoption
  - ATLAS specific implementations feasible
- Parallel USDP based development
  - Provide new insights
  - Validate & catalog experience based conclusions
- Merge in Sep 2000 release
- Feedback to GAUDI team

Future Releases

- September 2000
  - Merged USDP/GAUDI
  - Event Model
  - Run-time configuration
  - Error Logger
  - Histogramming
- October 2001
  - Bookkeeping
  - Physics Analysis Tool
  - Visualization
  - Statistics & Monitoring tools
  - Full Database integration

GAUDI Collaboration

- Development acceleration
  - Reuse of ideas, designs, code, *etc.*
- CERN leverage
  - GEANT4 integration?
- Not all collaborations have been successful
  - I don't think this will be a problem
    - Common abstractions, different implementations feasible
    - People involved have known each other for many years
  - We have necessary experience if need be
- Stress need for a rapid prototype that minimizes future upheaval for developers
  - Try to get interfaces stable as quickly as possible

Framework Personnel

- Architecture Team
  - Paulo Calafiura (LBNL - 50%)
  - David Quarrie (LBNL – 50%)
  - Craig Tull (LBNL - 100%)
- Framework Support
  - Chris Day (LBNL – 66%)
  - Charles Leggett (LBNL – 50%)
  - John Milford (LBNL – 50%)
  - A.N. Other (LBNL – 66%)
  - These require some additional funding
- Good ties to other US-ATLAS personnel
  - David Malon
  - Torre Wenaus, Srini Rajagopalan
  - *etc.*

Closing Remarks

- Many changes in last 6 months
- Architectural vision being established
- Implementation teams being put in place
- US-ATLAS playing leading role
  - Architectural team
  - Database
- Computing organization and plan still needs work

Closing Remarks (2)

- May 2000 prototype is feasible
  - Address credibility issues
- Putting a more detailed schedule in place
- Need to resolve issue of David Quarrie role (Chief Architect?) and funding
- Need to resolve issue of US funding (Chris Day?)